GRA, Incorporated
Economic Counsel to the Transportation Industry

Findings Report

Environmental Research Beyond 2000

Public Meeting,
Held on November 20, 1997

June 2, 1998

Prepared for:

Federal Aviation Administration
Office of Environment and Energy
Contract No. DTFA01-93-C-00066
Work Order 42

Prepared by:

GRA, Incorporated
115 West Avenue, Suite 201
Jenkintown, PA 19046

CONTENTS

Report of Findings
From Public Meeting

Environmental Research Beyond 2000

November 20, 1997

Introduction

In recent years, the impact of human activity on the environment has become an increasingly significant public concern. The aviation industry has not been exempt from this concern on the part of governments and the public constituencies they represent. For aviation, as for any industry, effective responses to these impacts require an understanding of the interactions between its activities and the environment. Such understanding provides the foundation on which to build new technologies and approaches that can reduce and/or mitigate any negative environmental impacts of aviation-related activities.

The Federal Aviation Administration (FAA) Office of Environment and Energy (AEE) is responsible not only for increasing the nation's understanding of aviation's impact on the environment, but also for using this understanding to identify and develop more effective ways of limiting these impacts while allowing continued enjoyment of the many benefits provided by a growing and vibrant aviation industry. Because of these responsibilities, research and development (R&D) plays an important role in AEE activities. With the exception of its responsibility for supporting FAA compliance with Federal environmental, workforce protection, and energy conservation policies, AEE relies on the success of its own and other R&D efforts for achieving each of the goals set forth in its mission statement. AEE's mission statement is shown as Figure 1.

Figure 1. FAA Office of Environment and Energy Mission Statement

MISSION STATEMENT

The FAA Office of Environment and Energy

- Develops, recommends, and coordinates national aviation policy relating to environmental and energy matters.
- Provides instructions, guidance, oversight and technical assistance for FAA compliance with applicable environmental, occupational safety and health and energy statutes and regulations prescribing Federal environmental protection, worker protection, and energy conservation policies.
- Formulates and implements technical programs leading to reduced aircraft noise and exhaust emissions and to improved environmental conditions around airports.
- Develops, recommends, and promulgates regulations and standards, as appropriate to meet statutory requirements or Departmental and agency policy.
- Conducts analyses and studies of aircraft and airport operations and development programs, which could lead to the reduction of any adverse impact on the environment while maintaining the efficiency and capacity of the National Airspace System.
- Coordinates with other Federal agencies in developing aviation-related environmental and energy policies, goals, and priorities.
- Provides the agency focal point for coordinating and fostering community, State, local, and general public participation in the resolution of aviation-related environmental and energy matters.

AEE also relies on its ability to communicate with the public, the aviation industry, and the research community for identifying and responding to aviation's most important impacts on the environment. The significance of public input for AEE decision-making on R&D priorities has increased as claims on a declining FAA R&D budget have intensified. When it is not possible to pursue every avenue of research, it is essential that the projects that are undertaken provide the greatest possible environmental and public benefit. The need to focus and monitor its use of scarce R&D resources effectively has led AEE to begin its Environmental Research Beyond 2000 program. To better define the research agenda for Environmental Research Beyond 2000, AEE will seek input from the many stakeholders in the U.S. aviation system, including concerned citizens, in the early stages of the program's development.

Environmental Research Beyond 2000

On November 20, 1997, AEE hosted a public meeting in Washington, D.C. to present the Environmental Research Beyond 2000 program to interested members of the public. More importantly, the public meeting provided an opportunity for members of the public to present AEE with ideas and comments related to future directions in aviation-related environmental R&D. Notice of this public forum was published October 16, 1997, in the Federal Register. This Findings Report summarizes the information on Federal aviation-related environmental research presented by Federal representatives at that meeting to members of the public as well as the issues raised by speakers at the meeting.

As noted in the Federal Reserve notice, the agenda for the meeting included:

- **Presentation of the Environmental Research Beyond 2000 program, outlining objectives and goals for research activities undertaken by AEE.**
- **Presentation of examples of recent and on-going environmental research by FAA and other Federal agencies and interagency groups.**
- **Public comment and discussion of aviation-related environmental issues and concerns.**

AEE sought public comment and information regarding six questions:

1. **What aviation environmental issues concern you most and how does each affect you?**
2. **How successful have existing aviation remediation and mitigation policies been in responding to the impact of aviation activities on the environment?**
3. **What is being done to address your concerns and how effective is it?**
4. **What should be done to address your concerns?**
5. **What role does research have in addressing your concerns?**
6. **Are important effects of aviation activities on environmental quality currently not addressed in government policy and scientific research?**

The public meeting was an essential first step for defining an agenda for Environmental Research Beyond 2000. This Findings Report, based on the meeting, will be used as a guiding document for a future Findings Workshop. This workshop will be conducted with representatives of academia, other Federal Agencies, aviation interests, and other stakeholders, and will provide additional input for the development of a plan for future AEE research activities. This research plan, along with the findings that support it, will be submitted as a proposal for R&D funding to the FAA Research, Engineering, and Development (RE&D) Advisory Committee and its Advisory Subcommittee on Environment and Energy.

Presentations by Federal Agencies

The meeting was opened by the Director of the Office of Environment and Energy, Mr. James Erickson, and an introductory presentation of the Environmental Research Beyond 2000 program was made by Mr. Jim Littleton of AEE. As indicated by Mr. Erickson in his opening remarks, this program is based on AEE's recognition that the effects of aviation on public health and well being are the major impediment to aviation growth. With this new research program, AEE will continue to provide strong national and international leadership in mitigating adverse environmental impacts on the public while serving as an advocate for the diverse concerns of aviation stakeholders.

FAA, and the Office of Environment and Energy, regard aviation's environmental effects as impediments to aviation's future growth and development, in the sense that without successful mitigation or reduction, these effects, and the public response to them, will make growth impossible. While aviation provides significant benefits for a vital and expanding economy, these benefits will not be achieved if their environmental cost is too high.

The Environmental Research Beyond 2000 program will improve AEE's ability to fulfill its overall environmental strategy. With improved long range planning for its environmental R&D activities, AEE will be better able to develop cost effective solutions for aviation-related environmental issues. This strategy includes promoting compatibility between current and future environmental concerns and the activities of other FAA program offices. By organizing its R&D activities around specific long-term goals, and by providing aviation interests and other stakeholders with a role in defining these goals, AEE will be a more effective regulator in the environmental area, better able to recycle, retarget, and refine its use of limited research resources.

An overview of the FAA's RE&D Advisory Committee's structure and of the funding of AEE research in recent years was given by Mr. Paul Dykeman, AEE Deputy Director. Notably, overall annual RE&D funding within FAA fell from more than $250 million in FY94 to less than $200 million in FY98, and

AEE's annual RE&D funding fell from more than $5 million to less than $3 million over the same time period.

Mr. Tom Connor of AEE discussed the environmental component of FAA's strategic plan, which recognizes aviation's environmental impacts as the major impediment to airport development and aviation system expansion. Attaining the goals of international leadership for FAA in reducing the impact on populations of aviation noise and minimizing global and local environmental impacts of aircraft emissions demands a strategic plan for environmental mitigation that AEE will develop through an on-going and interactive public process.

Future aviation-related environmental R&D will improve AEE's effectiveness in several program areas, including the development of international aircraft noise and engine exhaust emissions standards, aircraft noise and emissions certification procedures, and computer-based environmental impact assessment models. These program area often overlap both with one another within AEE and with R&D efforts by other Federal agencies, especially the National Aeronautics and Space Administration (NASA). Mr. Connor described AEE program activities directed toward measuring aviation-related environmental impacts and assessing the compatibility of these impacts with existing regulatory legislation and standards. He also identified organizations and forums in which FAA and AEE participate in order to maintain contact and influence both with stakeholders in the U.S. and with foreign and international aviation regulatory agencies and organizations.

An important partner with FAA for combining regulatory and R&D approaches to environmental mitigation is NASA. Mr. Howard Wesoky of the NASA Research & Technology Division provided a summary of NASA areas of R&D activity for ensuring the environmental compatibility of an expanding aviation system. While most NASA research is directed toward long-term high-risk/high-payoff technologies, NASA also conducts collaborative research with FAA in environmental and other areas. Like AEE and FAA, NASA relies on effective collaboration with aviation stakeholders and the public to keep its research efforts "well-grounded" in the actual environmental problems affecting industry and the public.

Mr. Wesoky placed the NASA environmental R&D program in the context both of current White House policy—which includes the goal of ensuring long-term environmental compatibility of the aviation system—and of broad NASA R&D policy. NASA's "Three Pillars" framework for R&D in Aeronautics and Space Transportation Technology includes (within the Global Civil Aviation "Pillar") R&D efforts directed at two "enabling technology goals:"

- **Reduce emissions of future aircraft by a factor of three within 10 years, and by a factor of five within 20 years.**

- **Reduce the perceived noise levels of future aircraft by a factor of two from today's subsonic aircraft within 10 years (a reduction of about 10 EPNdB), and by a factor of four within 20 years (a reduction of about 20 EPNdB).**

Attaining these goals will require assistance from and collaboration among all stakeholders in the aviation system, both in defining the metrics for measuring progress toward the goals and in developing the technologies necessary for achieving them.

Public Input and Comment

Between 40 and 50 people attended the meeting; names and affiliations of those who used the sign-in sheets are shown in Appendix 3.[1] Members of the public attending the meeting, and others who provided comments to AEE by mail and other outside means, voiced concerns on a variety of issues. The majority of these are related to the environmental effects of aviation activity in the vicinity of airports, including noise, air quality, and ground and ground water pollution from chemicals used in airport operations, such as deicers. Concerns were also raised with respect to the effects of aircraft emissions in the upper atmosphere and the effects on passengers of traveling in aircraft with controlled onboard environments. Also at issue was the adequacy of existing metrics for calibrating the environmental impact of aviation on persons and property, especially with respect to noise. There were also proposals to pursue alternative fuel and energy sources for aviation, reducing reliance on petroleum-based fuels.

The public comment portion of the meeting was moderated by Mr. Richard Golaszewski of GRA, Incorporated, an FAA contractor. There were nine speakers, identified in Figure 2.

---

1 There were two sign-in sheets available, one for those participating in the meeting, and a second to identify those participants who wished to be kept informed about details concerning future Workshops related to Environmental Research Beyond 2000. Many persons who wished to be kept informed about future activities did not sign both sheets. Because of this, the two lists are combined into a single list. All persons on the combined list will be informed of future program activities.

Figure 2. Speakers at FAA Public Meeting for Environmental Research Beyond 2000, November 20, 1997.

Speaker	Affiliation
Bonnie Wilson (BW)	Airports Council International
Mary Ellen Eagan (MEE)	Harris Miller Miller & Hanson
Don MacGlashan (DM)	U.S. Citizens Aviation Watch
Sherwin Landfield (SL)	Arlington County Civic Federation; Aviation Consumer Action Project
Barbara Paley (BP)	Cutler & Stanfield
George Frigon (GF)	Dames & Moore Consulting
Genevieve Walker (GW)	ex-Virginia Air National Guard
Bill Holmberg (BH)	Clean Airports Program
George Nichols (GN)	Metropolitan Washington Council of Governments; National Association to Insure a Sound Controlled Environment (N.O.I.S.E.)

In addition, Mr. Richard Mahr (RM) of Colonia, New Jersey, and Kenneth Hayes, M.D., (KH) of San Jose, California, and Director of Citizens Against Airport Pollution, submitted written comments, which are included with the written submissions provided by speakers.

In their comments and accompanying written submissions, these persons raised a number of issues with respect to environmental and health effects related to aviation. These issues (and the initials of the persons raising them) include:

- **Local air quality at and around airports (BW, BP, RM, KH)**
- **Research should identify alternative strategies for mitigation of air quality impacts (BW)**
- **Improvements in the efficiency of the aviation system may improve some environmental impacts by reducing aircraft fuel burn (BW)**
- **Improving public notification techniques for Federal agency public meetings (SL, GN)**
- **FAA regards environmental concerns primarily as "impediments" to aviation growth, and tends to pursue policies that promote the interests of the aviation industry, at the expense of public welfare (SL, BP)**

- **Effects of in flight environments on passenger and cabin crew health (SL)**
- **Airport reporting of environmental impacts (SL)**
- **Assessment of noise impacts, including those on property, flora, and fauna (SL, RM)**
- **Inclusion of all aviation stakeholders in agenda-building process (BP, GW)**
- **Noise / emission tradeoffs (BP)**
- **Increases in noise and emissions due to increasing numbers of operations or excessive operations (BP, RM, KH)**
- **Emissions from ground transportation to and from airports is an aviation-related environmental impact (KH)**
- **Interaction of chemical runoff and runway characteristics (porosity), with impacts on ground water (GF, RM)**
- **Improved airport storage and recovery facilities for chemicals used at airports (KH)**
- **Potential for alternative fuel types (BH)**
- **Significant noise impacts at levels below 65 DNL (GN, KH)**
- **Adequacy of Federal and local funding for noise mitigation programs (GN)**
- **Poor coordination among agency offices and other bodies concerning aviation activities having noise impacts (GN)**
- **Effect of increased use of PFCs by airports on incentives to meet national noise objectives (GN)**
- **Night noise disrupts sleep for those living near airports (RM)**
- **Physical impacts, including injury, from excessively loud single noise events (RM)**
- **Inadequacy of hush kits for Stage III compliance with noise restrictions (RM)**

Findings

Not all of the issues raised by participants in the Public Meeting can be suitably addressed by AEE research activities. For example, AEE cannot significantly influence the level of Federal funding for noise mitigation efforts, either nationally or at specific sites. However, many issues such as this are related to AEE's R&D goals or to the process by which AEE's Environmental Research Beyond 2000 will be developed. Several avenues of future activity for Environmental Research Beyond 2000 have been identified based on the public meeting. These findings, grouped by areas of focus, include the following:

Improving the Process for Developing the Research Agenda

1. **To reach those members of the public with aviation-related environmental concerns, it may be necessary to publicize events related to Environmental Research Beyond 2000 by means of multiple information outlets in addition to the Federal Register.**

2. **To obtain more representative information from those affected by aviation activities, it is necessary to develop a more detailed characterization of the**

many groups and organizations that are stakeholders in the aviation system, and to provide these groups a voice in developing the agenda for Environmental Research Beyond 2000.

Measuring the Environmental Impacts of Aviation and Aviation-Related Activities

1. **Existing measures of airport noise impact, such as DNL, may not adequately express the impact of these noises on affected persons and property. Additional research on noise metrics may add value by allowing a fuller characterization of the human impact of aviation-related noise. This may include an evaluation of the noise effects that would result from both an increased number of aircraft operations at airports and a change in the fleet mix using the airport system.**

2. **A fuller understanding is needed of the relationships between the handling and runoff of chemicals used in airport operations, such as deicers, the types of materials used in airport construction that come in contact with these chemicals, and the timing and extent of the release of these chemicals into the ecosystem surrounding the airport.**

Reducing and/or Mitigating Environmental Impacts of Aviation-Related Activities

1. **Negative environmental impacts from aircraft noise and emissions remain a growing problem in and around U.S. airports. Research addressing technical and operational aspects of these problems could provide significant benefits to communities affected by these impacts.**

2. **Institutional and financial arrangements governing airport operations may have environmental impacts, and assessment of innovations in these areas could include an environmental assessment. In particular, increasing use by airports of PFCs to supplement funds received from AIP grant programs may weaken the links between airport operations and national environmental policies.**

Next Steps

The findings listed above will be used to focus the agenda for the next step in the development of Environmental Research Beyond 2000, which is a Findings Workshop. This workshop will garner more detailed input on using research to address aviation-related environmental effects. This workshop will involve persons from academia, relevant Federal agencies, and interested aviation stakeholders throughout the private sector. Although the public

meeting provided little information on specific avenues for beneficial environmental research, it did provide information on the broad areas of environmental concern toward which future research should be directed. Once determined, the date and location of the Environmental Research Beyond 2000 Findings Workshop will be provided to all participants in the public meeting, and to any others who have asked to be kept informed This and other information related to Environmental Research Beyond 2000 can be found at the FAA Office of Environment and Energy web site

http://aee.hq.faa.gov/

by clicking in the AEE-100 Technology Division box.

AEE, as part of its collaboration with NASA environmental R&D efforts, is also participating in a series of research workshops organized by the NASA Environmental Compatibility Assessment program. This new effort, directed by Mr. Howard Wesoky, is based on NASA's assessment that environmental concerns, if left unaddressed, will pose a fundamental limitation on aviation's future growth. The workshops will allow collaboration among academic researchers, industry representatives, and public interest groups to assess long-term research strategies for reducing the impact of aviation on the human and physical environment. Mr. Jim Littleton and Mr. Tom Connor of AEE participated in the program's first workshop in March, 1998, along with representatives of other FAA program offices. Two additional Environmental Compatibility Assessment Research Workshops will be held in mid-May, 1998, and early July, 1998. Information on the Environmental Compatibility Assessment program will be posted within NASA's Office of Aeronautics and Space Transportation Technologies (OASTT) web pages, at

http://www.hq.nasa.gov/office/aero/oastthp/programs/programs.htm

Presentations by Representatives Of Federal Agencies

Environmental Research Beyond 2000

November 20, 1997

Jim Littleton, FAA Office of Environment and Energy

Environmental Research: Beyond 2000

Federal Aviation Administration
Office of Environment and Energy

Presentation Overview
Environmental Research Beyond 2000

- Introduction
- AEE Role
- Strategy
- Resources and Constraints
- Identifying Key Stakeholder Concerns
- Development Process
  - Public Meeting
  - Process
  - Intentions
- Outcome
- Comments

An Introduction to Environmental Research Beyond 2000

- **GOAL**: To remove/mitigate environmental impediments to aviation growth
- **INTENTIONS**: To achieve goal with participation from all interested parties
- **OBJECTIVES**: To identify R&D strategies for resolving environmental impediments and fulfilling environmental obligations

Role of FAA/AEE Environmental Research

- Provide strong leadership in mitigating adverse impacts on the public that is consistent with an effective aviation system
- Support the development of aircraft noise and emission certification standards
- Establish guidelines and develop computer models for assessing aviation environmental impacts

Overall Environmental Strategy

- Design cost effective solutions
- Provide stakeholders a voice
- Serve as an advocate for diverse stakeholder concerns
- Promote compatibility between environmental concerns and other areas of FAA research and policymaking

Resources for Environmental Aviation Research

- Resources are limited
  - Environmental research: 2% of the FAA RE+D budget
- We must make the best use of the resources available
  - Identify research projects critical to the FAA environmental mission
  - Identify research needs related to other FAA projects
  - Focus on research projects that produce the most benefits to the most stakeholders

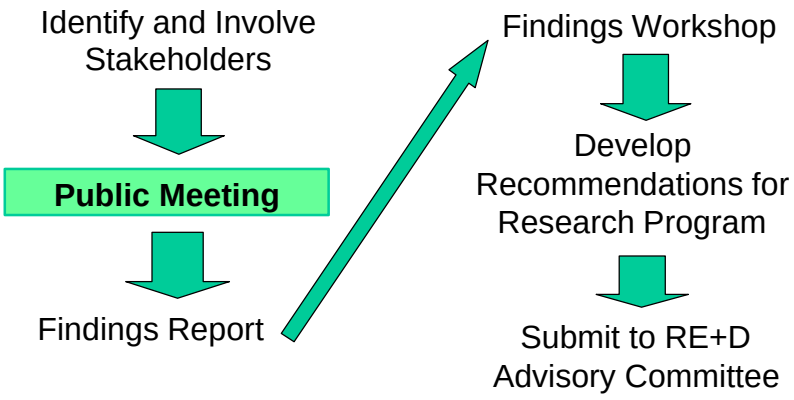
Stakeholders on Aviation Environmental Issues

FEDERAL AGENCIES	PRIVATE SECTOR
DOT/FAA	Public
NASA	Manufacturers
EPA	Air Carriers (Passenger and Cargo)
DOI/NPS	Airports

Development Process for Environmental Research Beyond 2000

- Identify stakeholder concerns and insights in public meeting, and prepare findings report
- Conduct findings workshop with representatives of Academia, other Federal Agencies, and other interested parties
- Develop a research plan using input from public meeting and findings workshop
- After PMT review, submit findings and research plan to FAA RE&D Advisory Committee

Process



Key Objective of Public Meeting Discovering Stakeholder Concerns and Insights

- What aviation environmental issues concern you most and how does each affect you?
- How successful have existing aviation remediation and mitigation policies been in responding to the impact of aviation activities on the environment
- What is being done to address your concerns and how effective is it?
- What should be done to address your concerns?
- What role does research have in addressing your concerns?
- Are important effects of aviation activities on environmental quality currently not addressed in government policy and scientific research?

INTENTIONS
Where Will the Process Lead?

- Design R&D effort to support a cost-effective environmental mitigation strategy
- Identify best approaches for addressing current and evolving environmental issues
- AEE role: disseminate and coordinate environmental R&D strategy
  - With public, industry, and academic stakeholders
  - Among affected program offices within FAA
  - With other government agencies

OUTCOME
Where Can New Environmental R&D Take Us?

- More Effective Regulation
- Continue to Recycle, Refine, and Retarget Funds
- Improved Ability to Advocate Environmental Research
- Federal Strategy of Responding to Concerns of Aviation Stakeholders
- Improved Ability to Anticipate Future Environmental Impacts of Aviation

Environmental Research Beyond 2000

A focused, cost effective environmental R&D program that can

- Identify, measure, and mitigate environmental consequences of aviation activities
- Ensure continued benefits from aviation growth with minimal environmental impact on public quality of life
- Provide improved environmental assessment options for FAA program offices

A Win/Win Solution for All Parties

Contact

Federal Aviation Administration
National Headquarters
800 Independence Ave., S.W.
Washington, D.C 20591

Office of Environment and Energy(AEE)
Phone 202-267-3576
Fax 202-267-5594
Web Address: AEE.HQ.FAA.GOV

Paul Dykeman, Deputy Director, Office of Environment and Energy

FAA R,E&D Advisory Committee

Role: Provide sustained, comprehensive involvement of customers, stakeholders, and subject-matter experts in R,E&D program reviews and investment decisions.

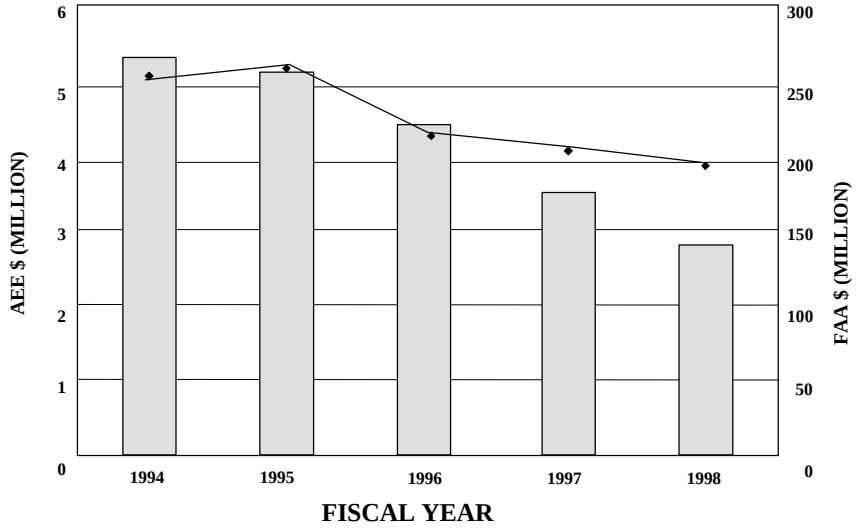
Members: Associations (5) Consumers (7) Corporations (9)
Government (2) University/Research Centers (5)

FAA R,E&D Advisory Subcommittee on Environment and Energy

Role: Provide advice and recommendations to the FAA on its research and development program in the environment and energy area.

Members: Associations (1) Consumers (2) Corporations (2)
Government (1) University/Research Centers (1)

RE&D FUNDING LEVELS



Tom Connor, FAA Office of Environment and Energy

FAA's
Research, Engineering, & Development (RE&D) Program

Environment & Energy

Program Area Description

Overview

- **Problem:** Aviation environmental impact is the major impediment to airport development and system expansion.
- **Objective:** FAA is the international leader in the mitigation of the environmental impacts of aviation.
- **Reality:** "...lack of an explicit mandate to address non-noise related issues, combined with FAA's small environmental R&D budget limit the agency's ability to move quickly on emerging issues." [U.S. Congress, Office of Technology Assessment, 1994]
- **Solution:** Develop a strategic plan for aviation environmental mitigation through an interactive public process.

Program Area Description

FAA's Strategic Plan (Environment)

✈ Mission

Aviation is a good neighbor.

✈ Goals

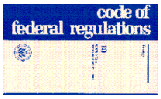
- Reduce the population impact of aircraft noise by 80% by 2000 and prevent any increase after the phaseout of Stage 2 airplanes
- Minimize the global, regional, and local impact s of aircraft exhaust emissions

✈ Approach

Mitigation = Source+Operation+Land Use
w/ Harmonization

Program Area Description

"Regulatory Research"



Aircraft Noise Abatement Act of 1968	→ *control and abatement*	14 CFR part 36	• Measurement test procedures
Noise Control Act of 1972	→ *technologically feasible and economically reasonable*	14 CFR part 36	• Technology assessment
Airport Safety and Noise Abatement Act of 1979	→ *noise compatibility planning*	14 CFR part 150	• Airport noise exposure modeling • Compatibility criteria
Clean Air Act of 1967 as amended	→ *(consult EPA on) engine emissions standards*	14 CFR 34	• Measurement test procedures Technology assessment
National Environmental Policy Act of 1969	→ *environmental consequences of Federal actions*	40 CFR parts 1500-08	• Environmental analysis tools (models)

Program Area Description

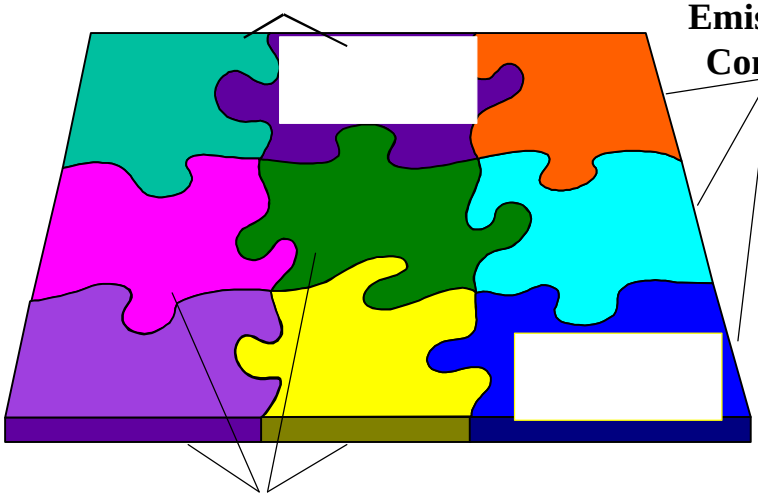
Program Area Outcomes

Guiding Principles

- **International aircraft noise standards** that are technologically feasible, economically reasonable, and appropriate to type.
- **International engine exhaust emissions standards** that consider the state of requisite technology and economic impact.
- **Effective noise and emissions certification procedures** that are cost efficient while maintaining the integrity of the process.
- **Computer models and impact criteria** that improve the quality of environmental assessments for better Federal decision making.

Program Area Description

Program Structure



Program Area Description

- **Aviation Regulatory Advisory Committee (ARAC)**

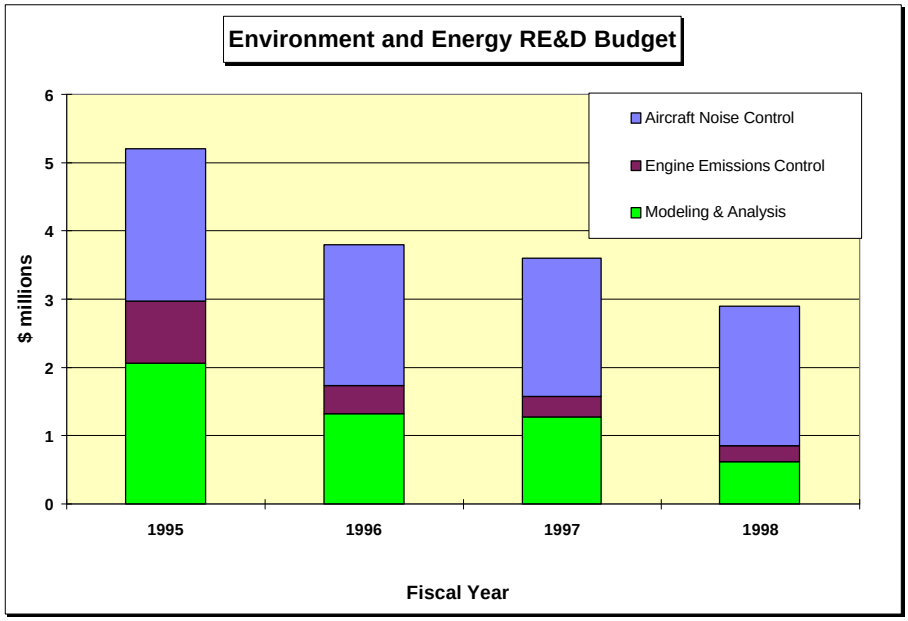
  International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP)
  to deliberate on international aircraft noise and engine exhaust

- **Federal Interagency Committee on Aviation Noise (FICAN)**

  Society of Automotive Engineers (SAE) Aircraft Noise (A-21) and Engine Emissions (E-31) Committees
  measurement and analysis practices.

Unified Regulatory-R&D Approach to Source Control

End Product	Subsonic Jet	Light Prop	Helicopter	Tiltrotor /wing	HSCT
Technology	NASA	NASA	NASA	NASA	NASA
	MOA	MOA	MOA		MOA
Certification Procedures	FAA	FAA	FAA		FAA
Noise Standards	FAA		FAA		FAA



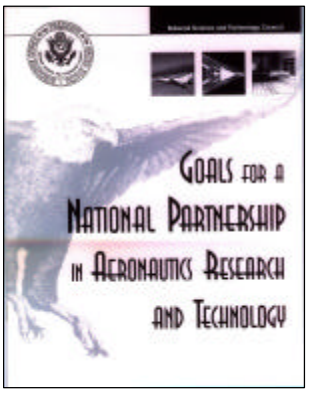
Program Area Description

Environmental Compatibility Research & Technology

November 20, 1997

Howard L. Wesoky
Research & Technology Division
National Aeronautics & Space Administration
Washington, DC

White House Policy

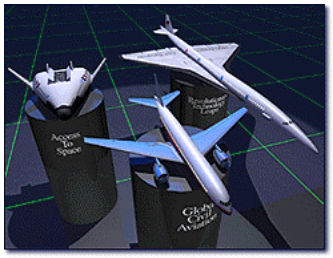


- Maintain superiority of US aircraft and engines
- Improve safety, efficiency, and cost effectiveness of global air transportation system
- **Ensure long-term environmental compatibility of aviation system**

"Past research investments in technologies to reduce engine noise and emissions are paying dividends today. But more needs to be done. Environmental issues are likely to impose the fundamental limitation on air transportation growth in the 21st century."

National Science & Technology Council, August 1995

Aeronautics & Space Transportation Technology: Three Pillars for Success

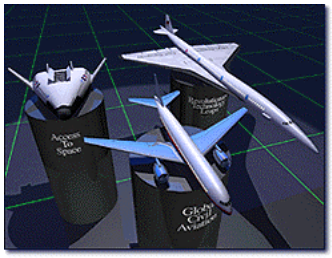


"My challenge to NASA's Aeronautics and Space Transportation Technology Enterprise to set bold objectives for the future . . . they are pre-competitive research endeavors in long-term, high-risk, high-payoff technologies. . . The value of our work to the U.S. taxpayer is the extent to which we add to the economic well-being and security of this country."

Daniel S. Goldin
Administrator
National Aeronautics & Space Administration
March 1997

Aeronautics & Space Transportation

Environmental Compatibility



fraction of the world's air pollution

interest of our nation to protect the

demonstrate leadership in setting and

for aircraft. We believe there are

signifi

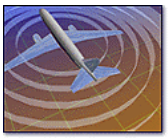
cantly

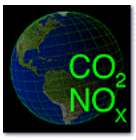
contribute to global warming and ozone

"Previous NASA noise-reduction research is now embodied in new aircraft entering the

Can we go further and create aircraft that are

comes from cars and buses?"



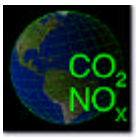


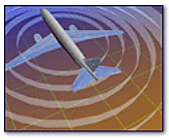
Enabling Technology Goals

"Throughout the pillars we present 'technology goals' which are framed in terms of a final outcome, the anticipated benefit of NASA-developed technology, once it has been incorporated by industry."

- **"Reduce emissions of future aircraft by a factor of three within 10 years, and by a factor of five within 20 years."**
- **"Reduce the perceived noise levels of future aircraft by a factor of two from today's subsonic aircraft within 10 years, and by a factor of four within 20 years."**

"Both of these environmental goals have the requirement to be achieved without affecting safety or affordability."



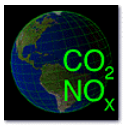


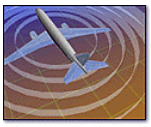
Enabling Technology Goal

"Reduce the travel time to the Far East and Europe by 50 percent within 20 years, and do so at today's subsonic ticket prices."

- Quiet supersonic engines able to meet subsonic aircraft noise standards
- Clean supersonic engines with emissions 75 percent lower than today's aircraft

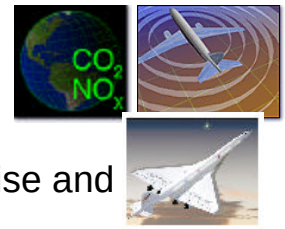
Assessment and Planning Activities





- Conduct workshops involving customers and program participants (e.g., FAA, EPA, industry, academia).
  - *– Aircraft technology*
  - *– Propulsion technology*
  - *– Operational measures and technology*
- Relate both emissions and noise requirements to:
  - *– Growing demand for aviation*
  - *– Scientific assessment of environmental impacts*
- Conduct "total" systems analyses
  - *– Determine the net effect of the total system on the world environment*
  - *– Understand relationships between science, regulation and affordability*

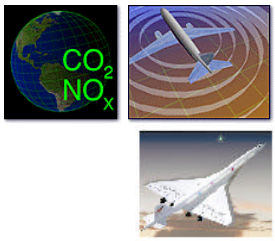
Environmental Compatibility Assessment



- "**What**" must be done to attain the noise and emissions goals of the "Three Pillars" challenge?
- "**Why**" are the stretch goals important for sustaining the growth of aviation?

Vision: In collaboration with carriers, manufacturers, academia and other government agencies, NASA will develop robust technology options which ensure that environmental issues do not constrain the growth of air transportation.

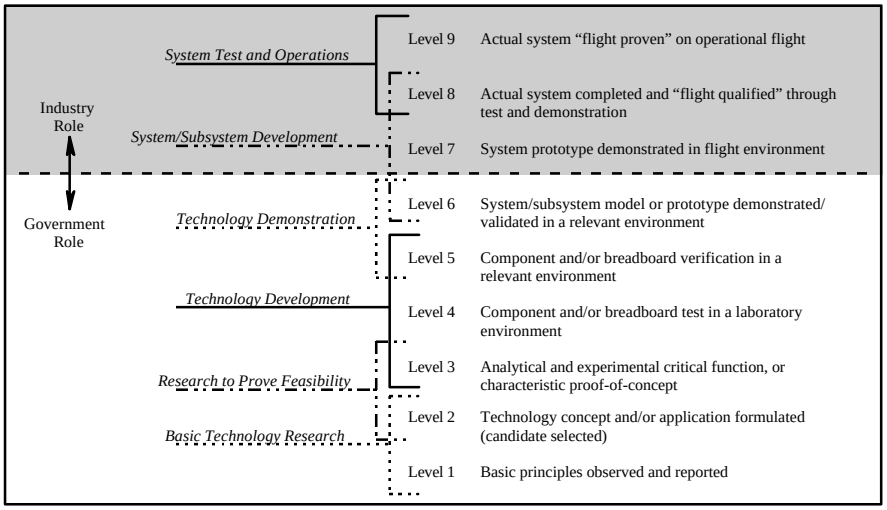
Assessment and Planning Activities (cont.)



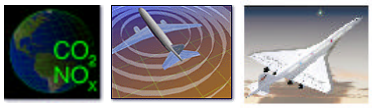
- Conduct "kickoff/outreach" activity:
  - *– Inventory of evolutionary technology*
  - *– Initial consideration of revolutionary concepts*
  - *– Initiation of "technology gap" analysis*
- Develop revolutionary concepts through NASA Research Announcements (NRA's)
  - *– Provide "level playing field" for all contributors*
- Sponsor initial effort within R&T Base in FY 1999
- Build to focused system tech program as appropriate

Assessment and recommendations complete by Sept 1998

Technology Readiness Levels



The Challenge!



"Environmental issues are likely to impose the fundamental limitation on air transportation growth in the 21st century."

National Science and Technology Council, Goals for a National Partnership in Aeronautics Research and Technology, August 1995.

"Traditionally, our technology development activity has been focused on reducing fuel burn and crew costs. While some advances may still be possible there, future attention will concentrate on utilization, maintenance and, finally, airplane price."

P.M. Condit, Performance, Process, and Value: Commercial Aircraft Design in the 21st Century, 1996 Wright Brothers Lectureship in Aeronautics, World Aviation Congress and Exposition, Los Angeles, October 1996.

". . . environmental goals have the requirement to be achieved without affecting safety or affordability."

"Aeronautics and Space Transportation Technology: Three Pillars for Success," March 1997

How can you help?

Work with NASA and FAA to ensure "connectivity" of efforts!

- What are your organization's top environmental problems?
- What do our goals mean to you?
- What would benefits of attaining the environmental goals be for you?
- How can you contribute/support?
- What role could you play?

Statements by Speakers
At Public Meeting

Environmental Research Beyond 2000

November 20, 1997

Bonnie Wilson (Airports Council International, North America)

I have some very brief comments. For those of you who don't know who I am, my name is Bonnie Wilson. I'm the director of Airports Facilities and Services for the Airports Council International, North America. We represent the commercial operations airports in the United States and Canada. Our biggest concern of course is restriction of airport operations, i.e., aircraft operations. The environment impacts that we have seen lately have led us to believe that there may be some restrictions if we don't do something to improve the conditions around airports as well as on the part of the industry as a whole.

I'm very, very pleased that the FAA has given us this opportunity to interact with them and set the research agenda for the industry as a member of that industry. I'm very happy to hear that the FAA will be coordinating internally as well as externally a couple of key offices here, the Office of Airport Safety and Standards, the Office of Community Environmental Needs, which I think can be very helpful in helping this group, the workshops, and the Office of Environment and Energy in determining what the needs are of my constituents, as well as the public and the air carrier and manufacturing communities.

We have been asked to identify one or two key things, and I'll keep it very brief. The noise issue is obviously something we've always been concerned about, and continued research on noise and reducing the impact of noise on our communities is vitally important.

In addition to that, we have begun to look at the impact of emissions, not only at the upper atmosphere levels, in the cruise levels, but also in and around the airports themselves. We would request that the Office of Environment and Energy do spend some of your limited research dollars on the impact of operational changes, such as Free Flight and programs of that nature, not only on what will happen as far as the cruise level emissions but also gains we can get on the ground level as well.

Improving the efficiency of our system will definitely give us reduced fuel burn. Reduced fuel burn obviously leads to reduced emissions as well. It's a big concern for us. We are in the position where we cannot look at expanding an airport without a conformity analysis that shows that we will have no impact or that impact can be mitigated. The second item on the list, then, of course, is mitigation alternatives as well, and the possibility of mitigation banks and things of that nature for credits.

So those are the two biggies. That's about all I have to say at this point. I'm sure we will have more. We would love to participate in the process as you continue on, and be players in the workshops. We do serve on the Aviation Rulemaking Advisory Committee, and any questions you have of us, any details we can give you, information, data, we'll be happy to do so.

Thank you.

Mary Ellen Eagan (HMMH) See written submissions.

Don MacGlashan (U.S. Citizens Aviation Watch) See written submissions.

Sherwin Landfield (Arlington County Civic Federation, Aviation Consumer Action Project)

Excuse the low tech ball point technology; my name is Sherwin Landfield and I owe much of the following input to the two groups for whom I am monitoring this meeting--the Arlington County Civic Federation of seventy associations within whose territory National Airport lies and the Ralph Nader founded ACAP (Aviation Consumer Action Project) on whose board I serve.

As a three point capsule response to the six key questions you have posed, I can say (1) existing mitigation policies are essentially a failure; (2) very little is being done to effectively address concerns; and (3) research does have a tremendous potential role to play. Therefore, your initiative is very welcome; however, asking the public to present their ideas after first presenting yours as a *fait accompli* will lead some cynics to suggest that your listening phase is less than wholly sincere. But, here are seven environmental groups for your research agenda.

Group 1--The Research Process

a. **You cannot get public citizen input until you research how to reach them. This meeting was a perfect example of how not to do it--through the Federal Register. I could not find anybody in the Metropolitan area, including the national organizations, who were aware of this meeting until three or four days ago.**

b. You might well research FAA attitudes and language that still treat the environment as a "impediment" to corporate benefits as you have in this meeting's public notice.

c. When you select your final agenda, and when you award your research contracts, make sure your criteria are above suspicion and the research results were in no way pre-ordained.

Group 2--The Inside the Aircraft Health and Safety Environment

a. Research an ideal fresh air exchange for cabin crew and passengers

b. Ditto for air pressure

c. Ditto for air humidity

d. Ditto for seat size and structure

e. Ditto for leg space between rows

f. Ditto for aisle width

g. For emergency transition to a watery environment, research availability of appropriate life saving equipment in the cabins. For example, all jet carrier takeoffs and landings at National Airport--the key airport of the capital of the world--are over water, but nothing is mentioned in the safety instructions, and I am sure there is no equipment.

Group 3--The Logistical Environment

a. Research what a healthy long distance maximum flight hop without passenger locomotion or rest is, and whether airlines are penalizing passengers when they attempt to break up flights into healthier segments, and whether they put pressures on sick people to not cancel or postpone thus risking their health and that of other passengers and crew.

b. Find out if the hub system doubles environmental pressures of noise and air pollution by converting one trip into two.

Group 4--Airport Locus and the Demographic Environment

a. What are the social, historical, health, safety, political and economic costs as a city grows and envelops an airport?

b. When should an airport site be moved or its growth frozen?

c. Who should monitor these changes and to whom should they report their findings?

d. As aviation standards continuously rise, should old airports as well as old airplanes be retired or retrofitted?

Group 5--Industrial Sharing of Environmental Responsibility

a. Does the airport industry measure and report its water pollution?

b. Ditto for air pollution?

c. Are other American industries bearing an undue environmental burden because airports don't bear their share?

Group 6--Noise Pollution

a. Are the U.S. noise standards stacked against the public?

b. Are impacts on hospitals, schools, and parks treated and counted as only a single residence?

c. In international conferences, is the United States in the vanguard or the rear guard?

Group 7--The Less Visible Environment

a. What are the effects of aviation vibration on people and property, particularly historical and preservation property?

b. What are the effects of hills, forests, bodies of water and buildings on absorption, reflection, and dispersion of noise?

c. Are we sufficiently protected from the effects of aviation-produced air turbulence on impacted ground areas, and in heavily concentrated air corridors when flying?

Thank you for your patience.

Barbara Paley (Cutler and Stanfield)

Good morning, my name is Barbara Paley, and I'm with the firm of Cutler and Stanfield, here in Washington D.C., and as some of you may know, we are a law firm many of whose clients are members of some of the groups that have spoken here. Many of these clients are host communities to airports that they do not own and have had some problems in that respect. I just would like to throw out a few issues that I think, from the perspective of some of our clients and including our clients that are airport proprietors, would just like to put on this agenda. One of the things that I was interested in is that in the listing of stakeholders and in the discussion of what is the public—the public is often thought of by the FAA in these kinds of processes as sort of this inchoate group of individuals, non-governmental interest groups, lobbying organizations.

I think another aspect of the public, another group that is severely under-represented in all of these corridors of decisionmaking are local governments. These are governments, but not the Federal government, but these are governments that have responsibilities to their citizens to protect their health and welfare, in general terms. They are almost never represented in any of these kinds of discussions, and so I would urge you, in terms of the kinds of people and the kinds of views that you are trying to bring into this process, to invite local governments who are not airport proprietors but in whose jurisdictions airports are located, or adjacent to which airports are located, to participate.

A second issue, and this has been raised by a couple of the previous speakers, is the feeling that FAA really isn't interested in environmental issues and environment concerns except to clear them away as an "impediment" to airport expansions. In fact, issues like noise and growing concern with aircraft emissions and air pollution, are becoming something more of an impediment, if you will, or something that has to be overcome in terms of airport expansions. We would urge that FAA, in this research agenda, look at ways in which there are opportunities to work with localities to resolve these questions, and not see them only as impediments and obstructionism. The FAA perhaps as part of this research agenda can consider how it can get involved, in a pro-active fashion, with local communities and airports who want to work together to resolve these problems. Typically and traditionally, the FAA has refused to participate in that kind of interchange and in that kind of interaction.

There are also two specific areas, both of which have been mentioned but

I'd like to mention them again. One of them is aircraft emissions which is becoming more and more of a concern to the public and to the localities and to areas around airports. The FAA hasn't really devoted a lot of attention to that, and we think that something really needs to be done in this area, in terms of research as to what are the problems and what kinds of solutions might there be, including what is the interaction between noise restrictions and aircraft emissions. It's my understanding that quieter aircraft engines also produce more NO_x. Are we trading off one problem for another? Another issue, of course, is the issue of noise and what happens after Stage 3? We heard today that one of the things that FAA wants to prevent is the increase in noise levels and traditional wisdom has it, as the speaker from HMMH said, that even though Stage 3 is supposed to lower aircraft [*noise*] levels, even if there is an increase in the number of operations, nobody believes that, and there isn't a lot of confidence in that. Unless it can be demonstrated, I think we're going to have a whole new can of worms in that area. I think the FAA really needs to look at the post Stage 3 environment as well.

Thank you.

George Frigon (Dames & Moore)

I'm from Dames & Moore consulting firm, and our connection with aviation, or my personal connection with aviation is primarily in the area of aircraft deicing and storm water environmental effects. I thought it was important to point out that this area is very much drawing a lot of interest at this time, but the technologies and the approaches are pretty much in chaos. Other than the SAE, no organization has taken the leadership role to focus the efforts of the airports around the country and the air carriers in dealing with this issue.

In our efforts, working with airport operators trying to address the deicing issue, we have noticed that the problems go way beyond the issue of spraying material on planes and dealing with its environmental impact. There are a lot of other issues that affect storm water, the conveyance of storm water with these airports that are not up on the radar screen as environmental problems right now, but will be in the future. For instance, one of the issues is airport pavement porosity and the ability of contaminants to get down into the subsurface and then be released over a long period of time. We've noticed just in our work on deicing that something needs to be done to address this in order that all the collection activities or the collection devices and strategies that are put in place can work effectively, because as long as the pavements are porous, any effort to collect can be circumvented, at least partially. So we think there's an enormous area for a lot of research here, and we think FAA is an appropriate agency to serve as leader.

Thank you.

Genevieve Walker

My name is Genevieve Walker, and up until a couple of months ago I was the environmental engineer at the Virginia Air National Guard. I'd like the FAA to consider the Air National Guard as a stakeholder in this. I don't see them listed anywhere as a Federal agency that they're consulting with, but Air Guard facilities are located at dozens of commercial airports throughout the country. Right now what's been happening is that the Air Guard sort of does their thing and the commercial airport does their thing, but there's a tremendous overlap between the activities and the types of impacts that the Air Guard does have, so I would like the FAA to please consider the Air Guard.

Thank you.

Bill Holmberg (Clean Airports Program, Sustainable New-Wealth Industries Inc. International) See also written submission.

My name is Bill Holmberg, and I am the president of a local company promoting renewable fuels in the transportation sector and the aviation field. I'm representing the Department of Aviation Science at Baylor University in Waco, Texas. We have launched a program called the Clean Airports Program. There are five such airports in the United States, all small with the exception of Will Rogers in Oklahoma City. It's just an emerging program. Initially we had the full support of the Department of Energy, but they have since relaxed that level of support.

Earlier this month we held a conference at Baylor University, the second International Alternative Aviation Fuel Conference. At that conference there was a great deal of enthusiasm for expanding the Clean Airports Program from the U.S. to other countries around the world, including those who were there and quite interested, Canada, Mexico, Brazil, U.K., France, Italy, Norway, and Sweden. The idea basically is to have this program cooperative and voluntary, and the focus, as far as Baylor University is concerned, is on information exchange, technology transfer, and education. The notion is that airports represent a microcosm of what the future could be, in terms of energy efficiency, renewable energy, environmental protection, waste recovery and recycling, etc. It's a unique opportunity since an airport is a place people grow to expect high technology, so the opportunity's there to do that, and that's our intention.

If anyone has a willingness to explore this with us, we're still in the beginning stages of this. Canada has taken a step forward. They have something up there called the Green Airports, and we'll be working closely with

them.

Thank you.

George Nichols (Metropolitan Washington Council of Governments, National Association to Insure a Sound Controlled Environment N.O.I.S.E.) See also written submission.

My name is George Nichols, and I am the Principal Environmental Planner for the Metropolitan Washington Council of Governments and the Secretary of the National Association to Insure a Sound Controlled Environment (N.O.I.S.E.). I'm speaking this morning on behalf of Tom Egan, the President of N.O.I.S.E, the N.O.I.S.E board, and members of N.O.I.S.E. We are pleased to have this opportunity to present some brief comments to you this morning, and individual members may like to submit comments later.

What I'm going to do is highlight briefly some concerns that N.O.I.S.E. has identified, but before I do that, let me say that, first of all, N.O.I.S.E. is a national organization of local governments, citizen groups, and others working to reduce the impact of noise on communities. The Metropolitan Washington Council of Governments is a member of N.O.I.S.E., and through its Committee on Noise Abatement at National and Dulles Airports, has involved in the national N.O.I.S.E. organization since its inception. N.O.I.S.E., as you know or some of you might not know, has long supported Federal policies to reduce unreasonable noise impacts on aviation by a combination of policies, including quieter aircraft, safe noise abatement procedures, and funding for local programs to achieve compatible land uses around airports. The Department of Transportation has recognized N.O.I.S.E. as the authoritative voice of cities and counties on these issues by appointing N.O.I.S.E. to bodies such as the steering committee of the NASA/FAA Advanced Subsonic Technology Noise Reduction Project, the Aviation Rulemaking Advisory Committee, and the FAA research boards. There's also an advisory committee of the interagency committee on international aviation that N.O.I.S.E. is a part of. Betty Ann Kranhke, who was here earlier and had to leave, would have been giving this testimony, but I am here in her place, in addition to Tom Egan.

The primary message that N.O.I.S.E. wishes to bring today is that airport noise continues to be a significant environmental problem, one that needs to be addressed, both from an environmental health standpoint to our communities as well as its potential constraint on airport and air transportation capacity. You've heard some mention of this from previous speakers, and I'm not going to go into a lot of detail as to why we should continue to provide research to noise issues at this point, but I will note that while noise contours are shrinking at most airports due to the phase-in of Stage 3 aircraft, an expected increase in the number of flights will basically expand these contours again in our future.

N.O.I.S.E. also has an increasing environment concern that the growth of air cargo operations will have a significant impact on communities throughout the nation, and that some attention should be given to those airports and to that type of research. Citizens continue, I think the point cannot be made enough, that citizens continue to experience significant noise at levels below 65 LDN. Therefore, regardless of whether the scientific community agrees to change that or not, some credence must be given to looking at this as a problem that someone has to deal with in the future. Citizens are going to continue to be significantly annoyed with aircraft below 65 LDN. That's another area of research that should continue to be given serious consideration.

I would also say that even under current operating levels, there exists a large backlog of noise mitigation needs. The Residential Sound Insulation Program, agreed to by San Francisco Airport and surrounding communities, for example, will cost over $135 million. It is our understanding that San Francisco Airport has committed to using its own revenue for this program to the extent not covered by Federal grants. To this end, you can see that this is fortunate, because the entire annual set-aside for discretionary funding for FY98 AIP appropriations for noise is only $200 million for the whole country. So the point here again is that someone is going to have to pay attention to what is going on in terms of how it impacts residents. Airports are using their own money to help bridge that gap, but more is needed.

I think the second point I'd like to make is that N.O.I.S.E. supports the Office of the Noise Ombudsman. N.O.I.S.E. was pleased when Congress reaffirmed its commitment for addressing aviation noise concern by establishing this office and requiring that any improvement in aircraft emissions not come at the expense of noise reduction. It is our understanding that the purpose of the Office of the Noise Ombudsman is to provide an independent liason between FAA and noise impacted communities, including notice of consultation before any overflight changes are made. N.O.I.S.E. applauds FAA for moving ahead and in implementing this new office, even without a budget during FY97.

But, the point that I want to make here is that even with creating an office, just creating an office does not mean that issues will be addressed or that the appropriate attention will be given to that office. For example, locally one branch of FAA gave approval to an operation for sightseeing flights over neighborhoods in the District of Columbia—this was a helicopter sightseeing operation. Not to mention that Metropolitan Washington Airports Authority was not even aware of this operation, neither were the local communities informed that this was going on. The point here is that simply creating an office is not going to address the concerns and some of the issues that we need to be addressed in noise abatement and the impact that airport and aircraft related decisions are having on the community.

Finally, there is a potential for erosion of environmental accountability to local communities through the shift to Passenger Facility Charges (PFCs) and other user fees as a source of airport project planning funding. N.O.I.S.E. is very concerned that this may create big problems in the future. These same concerns arise in the context of privatization experiments. This trend can also lead to a loss of the ability of Congress and the FAA to ensure that national noise objectives are met through the appropriations and grant-making process.

At this point I will close, and I thank FAA on behalf of N.O.I.S.E. and its board of directors for being able to provide these comments. I will also submit for the record a set of more detailed comments, from which what I have just stated is taken.

Roster of Participants
At Public Meeting

Environmental Research Beyond 2000

November 20, 1997

Participants in Public Meeting for *Environmental Research Beyond 2000*
November 20, 1997

Name	Affiliation	Name	Affiliation
Howard Aylesworth	AIA	David Lev	Volpe Center
Kelly Baker	SRC	Dr. John W. Leverton	GKN Westland
F. Barington	Volpe Center	Steve Linhart	URS Greiner
William Brown	Metro Wash Air Author	Don MacGlashan	Citizens Aviation Watch
John Chamberlain	Consultant	Victoria Matter	Sonnenschein Nath & Rosenthal
Joe Corrao	HAI	Fiond McKay	British Embassy
Vijay R. Desai		John Meehan	Air Transport America
Mary E. Eagan	HMMH	Carter Morris	AAAE
T.G. Fleming	FAA	Jim Muldoon	FAA-AEE
George Frigon	Dames & Moore	Barbara Paley	Cutler & Stanfield
Charlotte Garvey	Noise Regulation Rpt	Rick Peri	NATA
Bill Glover	Boeing	Clemans A. Powell	NASA
Parnal Hayes	British Embassy	William Sanderson	Helicopter Assoc. Int'l
R.B. Hixson	FAA/AEE-300	George Sauter	Pratt & Whitney
Betty Ann Kane	Noise	Warner Session	Session Law Offices
Richard Ketler	ATA	Jacob Snow	Airport Authority
Ed Kinkade	Sen. Torricelli (D-NJ)	Dave Turner	NRC
Steve Kistulentz	ACI-NA	Genevieve J. Walker	Consultant
Bob Klugiewicz	AIA	Susan Walsh	Pratt & Whitney
Ken Knopp	FAA Tech Center	John Williams	Leigh Fisher Assoc.
Anne Kohut	Airport Noise Report	Sandy Williams	Richmond Int'l Airport
John Kopecky	P&W	Bonnie Wilson	ACI-NA
S. Landfield	ACAP & ACCF		